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Behaviour of BL Lacertae during 1997-2001

M.G. Nikolashvili[1] and O.M. Kurtanidze[1,2]

[1] Abastumani Observatory, Abastumani Georgia e-mail: blazar@kheta.ge
[2] Astrophysikalisches Institut Potsdam, An der Sternwarte 16, D-14482 Potsdam and Landessternwarte Heidelberg-Konigstuhl, D-69117 Heidelberg, Germany
e-mail: O.Kurtanidze@lsw.uni-heidelberg.de

Abstract. We present the results of optical observations of BL Lacertae from August 1997 to May 2002. The long-term, intraday and intrahour variabilities of BL Lacertae were studied on the bases of 317 and 259 nights, respectively. The maximum amplitude of the long-term variability in B band equals to $3^{m}_{.}0$ (rms=0.03). The variation in V and R bands are within $2^{m}_{.}71$ (0.02) and $2^{m}_{.}53$ (0.01), respectively. This means that variations are larger at shorter wavelength or the object become bluer in the active phase. It were also demonstrated that BL Lacertae shows intraday variability within $0^{m}_{.}30$ (0.02), while intrahour variability within $0^{m}_{.}10$ (0.01) magnitudes.

Key words. Active Galactic Neclei – BL Lacertae – Photometry

1. Introduction

BL Lacertae is the prototype of one of the most extreme subclass of AGNs. It was discovered in 1929 by Guno Hoffmeister, who found it to vary by more than a factor two in one week and classified it as a short period variable star (Hoffmeister et al. 1990) Since its identification as an extragalactic source it was the subject of numerous studies in many frequency bands. Historically, BL Lac is known to show $\sim 5^{m}_{.}0$ variation in optical band with episodic outbursts. Maximum variation in the infrared K band is $\sim 3^{m}_{.}0$ (Fan et al. 1998) During the summer 1997 outburst it showed a very strong activity including intranight ones. The strong activity was also detected in the radio, X-ray and γ-ray bands.

Send offprint requests to: M.G. Nikolashvili
Correspondence to: 383762 Abastumani, Georgia

2. Observations and Data Reduction

We are intensively monitoring BL Lacertae at Abastumani Observatory since Aug 1997, when it remained in a high state for more than two months. Rapid and large-amplitude flux variations characterized the source during this period. Here we present observations carried out from Aug 1997 to Nov 2001. All observations were carried out with 70-cm meniscus telescope and ccd camera ST-6 attached to the Newtonian focus (1/3). To study the long-term variability we observed BL Lacertae during 317 nights, collected 320 frames in every of the BVI bands and 465 frames in R band. More than 16 000 frames were obtained in R band during 259 nights to study intraday variability and intrahour variability. The duration of observational runs varied from two hours to six hours. The exposure times varied from 60 to 180 sec depending on the brightness of the object and the filter used. Instrumental differential magnitudes were calculated relative comparison stars C and H, that have nearly the same colours as the object under study.

Observ.Periods	Frames	ΔR
08.1997 - 05.1998	74	$2^{m}_{.}53$
05.1998 - 08.1998	39	1.10
08.1998 - 01.1999	50	0.80
05.1999 - 08.1999	78	0.90
08.1999 - 06.2000	72	1.85
07.2000 - 11.2000	69	1.40
05.2001 - 11.2001	83	1.80

3. Results and Conclusion

The results of optical observations of BL Lacertae during great summer 1997 outburst are presented by different blazar monitoring groups (Webb et al. 1998, Sobrito et al. 1999, Speziali & Natali 2000, Clements & Carini 2001, Villata et al. 2002, Villata et al. 2004ab).

On the basis of observations of BL Lacertae during the period from August 1997 to November 2001 it was clearly demonstrated that variations are larger in B band or the object become bluer in the active phase (Nikolashvili et al. 1999, Kurtanidze et al. 2001ab, Nesci et al. 2001).

Maximum variation was observed in B band during August 1997 and equals to $3^{m}_{.}0$ (rms=0.03), while the maximum amplitude in R band equals to $2^{m}_{.}53$ (0.01). The amplitudes of variation in R band during seven different observing periods are presented in the table.

The evidence of intraday and intrahour variabilities are practically found during many nights of observations. The typical intraday and intrahour variability amplitudes in R band are within $0^{m}_{.}30$ (0.02) and $0^{m}_{.}10$ (0.01) magnitudes, respectively. They are clearly demonstrated in the figure 8.

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